

CYCLONOME® STEPPING MOTOR

A simple approach to accurate Positioning, Counting, Converting, Synchronizing.

... With positive *magnetic* start-stop action ... at variable synchronous and asynchronous stepping rates.

TORQUE AND SPEED — delivers up to 5 inch-ounce torque in precise 18° steps — at up to 1000 steps/second.

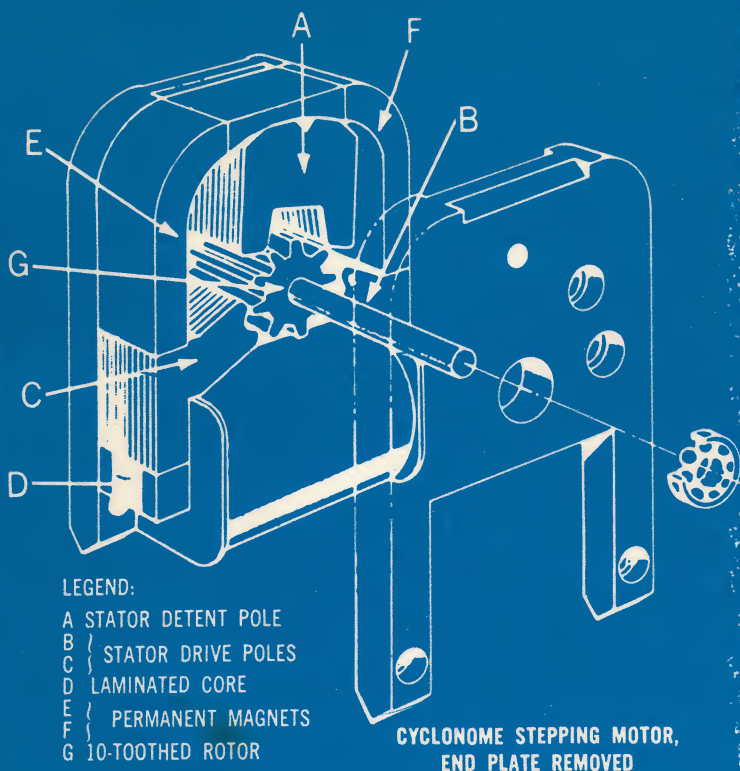
RELIABLE — only one moving part — no brushes, cams or ratchets.

ACCURATE — $18^\circ \pm \frac{1}{4}^\circ$.

VERSATILE — operates on a wide variety of single drive circuits without complex sequential switching.

SPACE SAVING — requires as little as one cubic inch of space.

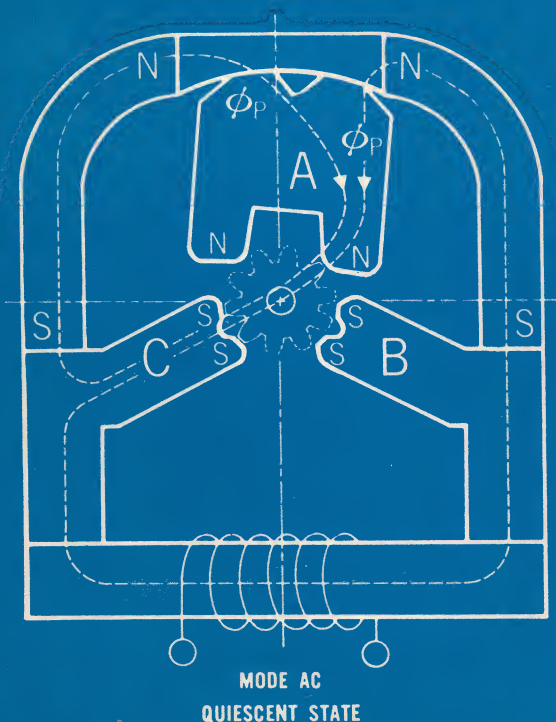
POWER SAVING — maintains higher holding torque without standby power.



The flux paths and rotor positions in one of the two modes in the Cyclonome's Quiescent State are shown below.

The operation of the Cyclonome Stepping Motor is a result of the following design features*:

- ... the special configuration of the rotor and stator teeth and their relationship to each other
- ... the uni-directional flux provided by the two permanent magnets in the stator circuit
- ... the alternating flux produced at the drive poles created by ampere-turn reversals in the stator winding.



*Patented

AN UNCOMPLICATED APPROACH . . .

The Cyclonome is a single phase, high torque, synchronous stepping motor that provides fast response stepping, instant stopping in precise 18° steps, delivering torque in exact proportion to and at the same rate as the input, i.e.

$$10 \text{ pulses} = 10 \text{ steps}$$

$$1000 \text{ pulses/second} = 1000 \text{ steps per second}$$

SIMPLIFIED OPERATION

The Cyclonome's operation is similar to that of a saturable reactor with a mechanical output. Its permanent magnets produce a uni-directional flux that, in effect, biases the motor so that an appropriate input signal can trigger it. The input then becomes a simple matter of ampere turn reversal.

The Motor's patented compact design uses only magnetic rotor-stator forces to convert frequencies or pulses into precise 18° start-stop shaft rotations. Mechanical aids such as clutches, brakes, and ratchets, are completely eliminated. Each motor excitation causes a fixed, incremental, angular shaft displacement, permitting twenty starts and stops for every revolution.

Exceptional Design Reliability

Since the Cyclonome's only moving part is a winding-less, low-inertia rotor which turns in instrument ball bearings, the Motor offers exceptional reliability over long life. There are no brushes or slip rings to wear out.

SIMPLIFIED DRIVES

Although the Cyclonome requires ampere-turn reversals to operate, its drives are numerous and simple and require no complicated sequential switching schemes. The same Motor without any changes can be driven from 60-cycle line power, oscillators, flip-flop circuits, pulsed R-C circuits, on off relay circuits, commutators and manual switches. Cyclopulser drive packages that step all cyclonome models up to the maximum rate are available.

Input-Command Versatility

Input commands may be in the form of steady pulse rates or random bursts (as in digital closed loop servos, high speed stepping machines, timing devices or variable speed applications) or number of pulses (as found in digital-to-analog converters, pulse counting, indexing, and positioning without feedback).

Higher Stepping Rates

Since the rotor is not required to carry a permanent magnet or windings, its mass and inertia are drastically reduced. The improved torque-to-inertia ratio permits much higher stepping rates than are possible with permanent-magnet or conventional rotor types. Input signal response is immediate. There is no "motor slip" as with typical synchronous types, and the synchronous speed is easily varied over a wide range by the input rate. Above its maximum stepping speeds, the Cyclonome behaves like a synchronous motor.

Extremely Low Power Consumption

Since no standby power is required for its holding torque, the Cyclonome's average power consumption is extremely low. This feature is particularly important in battery-powered portable instruments and equipments, space and airborne drives, remote location controls, and in high density packaging.

Built-In Memory

Two permanent magnets built into the stator of the Cyclonome produce a de-energized holding torque substantially higher than the driving torque. After each step, this holding torque prevents the shaft from moving another step unless properly energized. The ability to stay in a specified position ("memory") is an essential factor in remote positioning and permits the Motor to be used "open loop" in systems normally requiring feedback. It is particularly useful for random input applications where the pulse number, as well as the pulse rate, varies.

Wide Choice of Types and Accessories

Bi-directional models are also available for clockwise and counterclockwise stepping. These provide a rewind feature for incremental tape drives; reversible rotation for instrument drives; and open loop remote positioning of setpoint, gain and other functional controls in computer control systems; precise positioning in automatic machinery.

CYCLONOME® STEPPING MOTORS

Description	Model No.	Driving Torque (Saturate Current)	Holding Torque (No Current)	Operate Value (Ampere Turns)	Saturate Value (Ampere Turns)	Max. Stepping Rate without Damping (Low Speed)	Max. Stepping Rate with Damping (High Speed)	Size (Inches)	Approx. Weight (Oz.)
Standard Uni-directional	9AB2 Industrial 9AB3 Military	80 gm. cm. (1.1 in. oz.)	165 gm. cm. (2.3 in. oz.)	180	360	50	400	1-13/16 x 2-7/16 x 1-1/32	10
Standard Bi-directional	9AD2 Industrial 9AD3 Military	120 gm. cm. (1.7 in. oz.)	185 gm. cm. (2.6 in. oz.)	200	400	120	400	1-13/16 x 2-7/16 x 1-25/32	18
High Torque Uni-directional	9AG4 Industrial 9AG5 Military	350 gm. cm. (5.0 in. oz.)	450 gm. cm. (6.2 in. oz.)	300	600	100	500	1-13/16 x 2-7/16 x 1-5/32	12

CYCLOPULSER® DRIVE PACKAGES

Transistorized Enclosed (Med. to max. speed) 9F01

Transistorized Plug-in Module (Med. to max. speed) 9F02

CYCLONOME® STEPPING MOTORS COMPARISON CHART

This chart lists only the more frequently used types that are representative of the complete Cyclonome Stepping Motor line. For other stepping speeds, torques and sizes, complete packages, or special designs, consult our application engineering service.

Gentlemen:

Please send additional information on Cyclonome® Stepping Motors and Drive Packages. ☐

Please have your Sales Engineer visit me at his earliest convenience. ☐

I want to see a Cyclonome Stepping Motor demonstration ☐

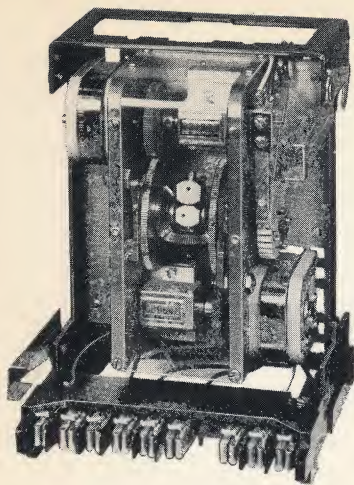
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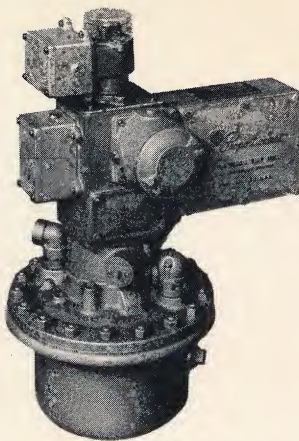
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TYPICAL CYCLONOME® APPLICATIONS



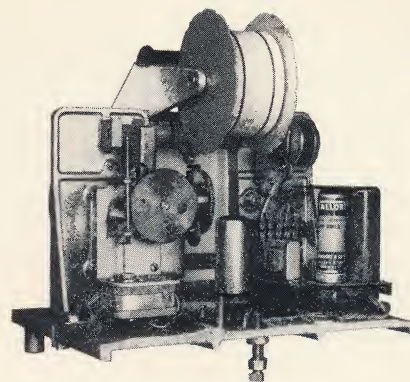
... adds and subtracts pulses for monitoring utility loads. Cyclonome permits remote reading of pulses via communication lines.

TYPE WD DIFFERENCE RELAY. Manufactured by Westinghouse Electric Corporation.



... rate of flow reference for control of blending process. Cyclonome provides an output speed that is proportional to variable input rate.

FLOW CONTROL UNIT, MODEL 2080. Manufactured by B-I-F Industries, A Division of The New York Air Brake Company.



... random pulse drive for positioning memory code discs. Cyclonome counts the random rate and positions the encoder for direct pulse-to-code conversion.

TRAFFIC COUNTER. Manufactured by Fischer & Porter Company.



... stepping servometer to maintain constant arc length. This simple, economical, null balanced system uses 60 cps line power to drive the Cyclonome (bi-directional model).

TUNGSTEN INERT-GAS ARC WELDING HEAD. Manufactured by Air Reduction Sales Company.



... 300 characters per second in read and write modes. Cyclonome provides positive indexing, each step moves tape exactly one character position.

TAPE READ/WRITE UNIT. Manufactured by Trak Electronics Company, Inc.

In these and countless other applications, Cyclonome Stepping Motors have been field proven for accuracy, performance and long life. Whatever your equipment design, consider the stepping function as a concept that can meet your needs — efficiently . . . economically . . . correctly. Prices range from \$30.00 to \$150.00 for single units.

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